1. Project Title:
Getting the AKT together: examining a critical junction in skeletal muscle metabolism.

2. Supervisor/s: (include affiliations)
Dr. Vernon Coffey, Exercise Metabolism Group
Prof. John Hawley, Exercise Metabolism Group

3. Contact: (name, phone number and email address)
Dr Vernon Coffey Ph: 9925 7356, Email: vernon.coffey@rmit.edu.au

4. Project Description

Aims/Hypothesis:
Elucidation of the mechanisms involved in the regulation of Akt activity is necessary to characterise the effects on skeletal muscle metabolic processes. Importantly, few works have investigated Akt activity in humans and no previous studies have examined the time-course of activation. This information will greatly enhance our knowledge of Akt kinetics and provide a framework with which to accurately evaluate Akt responses in future investigations. Therefore, the primary aim of the present study is to determine the specific time-course of Akt activation \textit{in vivo} human skeletal muscle following divergent contractile stimuli.

Background/Rationale:
Skeletal muscle cell-signalling networks are extremely complex with multiple points of regulation and signal divergence. However, “critical junctions” of important signalling cascades have recently been elucidated that provide insight into the metabolic actions of human skeletal muscle. The significance of the Akt junction is highlighted by its range of functions associated with many disease states prevalent in western societies. A dramatic loss of skeletal muscle mass is observed in aging populations and with numerous pathologies. Similarly, chronic disruption to skeletal muscle glucose uptake is a primary etiology in diabetes mellitus. Thus, given its intricate regulation of glucose metabolism and muscle mass, Akt represents an attractive therapeutic target for pharmaceutical and lifestyle interventions.

Outcomes/Benefits:
This will be the first study to determine the time-course of Akt activation and subsequent metabolic actions \textit{in vivo} human skeletal muscle. Accordingly, undertaking this investigation will provide the student with novel insight regarding the interactions of contractile activity and cell signalling processes.
1. **Project Title:**
Comparison of exercise training versus resveratrol ingestion on endurance exercise performance and skeletal muscle function.

2. **Supervisor/s: (include affiliations)**
Dr Andrew Carey, Professor John Hawley (RMIT SMS)

3. **Contact: (name, phone number and email address)**
Andrew Carey, 9925 7597, andrew.carey@rmit.edu.au

4. **Project Description**

**Aims/Hypothesis:**
The aim of this project is to determine if the gains in endurance exercise capacity and skeletal muscle metabolic function after prolonged ingestion of resveratrol (RSV) are as good or superior to chronic exercise training. It is hypothesised that RSV ingestion will improve aerobic exercise capacity and skeletal muscle metabolic functions, but not to the same degree as chronic aerobic exercise training. Furthermore, RSV ingestion will impair adaptation to exercise training.

**Background/Rationale:**
Prolonged ingestion of relatively large amounts of resveratrol, a polyphenolic compound found in small quantities in a limited number of foods, the most abundant and accessible source being certain types of red wine, was recently shown to markedly enhance endurance running capacity and insulin sensitivity in sedentary rodents. Therefore chronic ingestion of resveratrol is considered to be a pharmaceutical intervention that might be beneficial for enhancing exercise capacity and insulin sensitivity in sedentary and/or overweight individuals. Endurance exercise capacity and insulin sensitivity are well known to be enhanced by chronic aerobic exercise training, making physical activity the most potent tool for optimising metabolic function. Furthermore there is a strong link between aerobic exercise capacity and metabolic health in humans. Long-term ingestion of RSV is therefore a promising treatment for metabolic disorders, and indeed potentially an ergogenic aid for certain types of sporting events, but is yet to be thoroughly tested.

**Outcomes/Benefits:**
This project will show whether the newly discovered benefits on metabolic physiology of RSV ingestion can match the gold-standard for attaining optimal metabolic health and aerobic running capacity: aerobic exercise training.

This project will incorporate the need for both applied metabolic physiology measurements, and biochemical analyses for completion, therefore providing a broad range of research skills and knowledge application.
1. **Project Title:**
Effect of exercise training on metabolic characteristics of adipose tissue

2. **Supervisor/s: (include affiliations)**
Dr Andrew Carey, Prof John Hawley

3. **Contact: (name, phone number and email address)**
Andrew Carey, 9925 7597, andrew.carey@rmit.edu.au

4. **Project Description**

**Aims/Hypothesis:**
This project aims to analyse how metabolic functions of adipose tissue change after an exercise training intervention.

**Background/Rationale:**
Skeletal muscle is a critical controller of metabolic health in humans. White adipose tissue (WAT) is emerging as a key contributor to metabolic health in humans, but its characteristics have not been as well described in individuals of disparate metabolic function. Moreover, the development of brown adipose tissue (BAT), a type of fat tissue that is virtually absent in adult humans, but is present and provides a great deal of energy expenditure in some other mammals, is now thought to be a promising, although somewhat hypothetical, target for obesity related disorders. Markers of BAT are detectable in human WAT, but the degree and situations to which these are detectable are varied and somewhat controversial.

Prolonged endurance exercise training enhances general aerobic fitness and metabolic health. It also promotes efficient use of energy, which is in contrast to the energy 'wasting' effect of activated BAT. Therefore it is necessary to determine if regular exercise stands in the face of BAT development, which is a currently proposed therapeutic intervention for obesity-related disorders.

**Outcomes/Benefits:**
This study will provide knowledge as to whether regular exercise training, the gold-standard treatment intervention to optimise metabolic health, stands in the face of the development of BAT in humans, which is considered a future treatment of obesity.

This project will incorporate the need for both applied metabolic physiology measurements, and biochemical analyses for completion, therefore providing a broad range of research skills and knowledge application.
1. Project Title:
Effect of exercise training on skeletal muscle expression of sirtuin proteins

2. Supervisor/s: (include affiliations)
Dr Andrew Carey, Prof John Hawley

3. Contact: (name, phone number and email address)
Andrew Carey, 9925 7597, andrew.carey@rmit.edu.au

4. Project Description

Aims/Hypothesis:
The aim of this study is to determine how exercise training effects the expression of proteins in skeletal muscle that have been shown to have a considerable impact on lifespan in a number of organisms. Because the nature of one of the primary functions of these proteins is to switch off gene expression, it is hypothesised that chronic exercise, and its requirement to regularly switch on appropriate adaptive genes, will reduce the expression of these proteins in skeletal muscle.

Background/Rationale:
Members of the sirtuin family of deacetylase proteins are directly involved in regulating lifespan in simple organisms such as yeast, worms and flies, and some evidence suggests a similar role in humans. Traditionally their primary role is gene silencing. However new evidence suggests certain sirtuins are important in controlling metabolic function in skeletal muscle.

Exercise training induces adaptations that promote improved metabolic function and health, through activation of many cell signalling pathways that activate expression of numerous genes. This stands in contrast to the primary role of sirtuin proteins in gene silencing. Although the effect of training is not to prolong lifespan per se, both sirtuin activity and exercise training are both considered to promote a healthy lifespan, and it is of considerable importance to learn whether regular exercise impairs the lifespan extending properties of sirtuins in a tissue such as skeletal muscle, in which cells are expected to last the lifetime of the person.

Outcomes/Benefits:
Few studies have examined the expression of sirtuin proteins in humans, and none in response to regular exercise training, which is a primary lifestyle factor aimed at optimising length of life. This study will provide knowledge as to the effect of aerobic exercise training on these important regulators of cell function.

This project will incorporate the need for both applied metabolic physiology measurements, and biochemical analyses for completion, therefore providing a broad range of research skills and knowledge application.
1. Project Title:
The impact of a lifestyle intervention program on cardiovascular and diabetic risk factors in obese adolescents

2. Supervisor/s: (include affiliations)
Dr Amanda Benson/ Dr Steve Fraser, Discipline of Exercise Science, School of Medical Sciences

3. Contact: (name, phone number and email address)
Amanda Benson, Tel: 9925 7677, Email: amanda.benson@rmit.edu.au

4. Project Description

Aims/Hypothesis:
A cognitive behaviour therapy (CBT) program will elicit improvements in blood markers of cardiovascular and diabetic risk in obese adolescents. The CBT program was designed specifically for the treatment of overweight and obese Australian adolescents. Blood samples were collected pre and post treatment as part of the 10-session treatment program, which used cognitive behavioural therapies to promote the initiation and maintenance of long term behavioural changes of eating and activity habits. These blood samples were frozen and the Honours student will conduct analysis to investigate the changes in cardiovascular and diabetic risk after the intervention. These markers include fasting blood glucose, HbA1c, insulin, leptin, C-reactive protein and adiponectin. This study will investigate whether the CBT improves these associated biological markers.

Background/Rationale:
The incidence of obesity and type 2 diabetes has increased in Australia and the rise in adolescent obesity has doubled in the past decade (Magarey et al., 2001, Hotu et al., 2004). Evidence based best practice for the treatment of obese adolescents is limited and cognitive behaviour therapy has been shown to be an effective treatment option in this population (Brennan et al., 2006). Obese adolescents are at an increased risk for the development of type 2 diabetes and cardiovascular risk factors.

Outcomes/Benefits:
This research will add significant biological data to support a key research initiative (Choose Health Program) in the School of Medical Science. At least one peer-reviewed publication will be produced.

The student will gain insight into the research and scientific research process as well as developing specialist laboratory skills.
1. **Project Title:**
   The effect of eccentrically-biased resistance training on skeletal muscle architecture and force-velocity characteristics

2. **Supervisor/s: (include affiliations)**
   Tony Shield (Exercise Sciences RMIT)

3. **Contact: (name, phone number and email address)**
   Tony Shield, Tel: 9925 7337, Email: anthony.shield@rmit.edu.au

4. **Project Description**

   **Aims/Hypothesis:**
   We intend to test the hypotheses that eccentrically-biased resistance training will result in increased fascicle lengths and have a greater effect on high-velocity muscle power and force than conventional resistance training.

   **Background/Rationale:**
   It has recently been shown that eccentrically-biased resistance training utilising a flywheel device causes a rapid increase in muscle fascicle length (Seynnes et al 2007). This adaptation, which does not occur after conventional resistance training, should theoretically result in enhanced force and power generating capacities when muscles shorten at relatively high speeds. Muscle power during rapid concentric actions is not only an important determinant of sports performance but also significantly influences gait and risk of falling in the elderly. Furthermore, it has been proposed that increasing the number of in-series sarcomeres in muscles like the hamstrings would significantly reduce the risk of muscle strain injury. Consequently, methods that can improve high velocity power and increase fascicle length could be of great value in a diverse range of applications.

   **Outcomes/Benefits:**
   The proposed study will examine the effect of eccentrically-biased resistance training on muscle power and force-velocity characteristics. This work should lead to the development of more effective exercise prescription guidelines. It is expected that the proposed research project will lead to a peer-reviewed publication and, possibly, a poster presentation at an appropriate local conference. The Honours student will obtain experience in planning and carrying out research into the positive effects of exercise training on human performance.
1. **Project Title:**
Video-based perceptual training of anticipatory skill in cricket batting

2. **Supervisor/s: (include affiliations)**
Dr. Sean Muller (RMIT) & Professor Bruce Abernethy (University of Hong Kong/University of Queensland)

3. **Contact: (name, phone number and email address)**
Dr. Sean Muller, Tel: 9925 7349, Email: sean.muller@rmit.edu.au
Professor Bruce Abernethy bruceab@hkucc.hku.hk

4. **Project Description**

This honours project will form part of a larger project being undertaken by Dr. Sean Muller, titled: training the visual anticipation skills of cricket batsmen funded by Cricket Australia and RMIT Emerging Researcher grants for 2008. The purpose of the honours project is to examine the value of 2-dimensional video simulation training to the enhancement of anticipatory skill in intermediate level cricket batsmen and its transfer benefit to a natural setting of the skill. A group of batsmen (n = 8) from club cricket in Melbourne will be recruited and given a 6 week training program consisting of them watching video footage of bowlers’ deliveries that are blocked out (temporal occlusion) at different points during the bowler’s action and ball flight. After temporal occlusion, participants will be required to verbally report the type of ball with feedback provided of the correct decision. Comparison will be made to a control group that receives no training (data to be collected in 2007). Pre and post testing will involve instruments developed by the supervisors. The project will follow-on from experiments conducted in 2007 investigating anticipation training in the natural skill setting using vision occlusion spectacles as an intervention tool. Collectively, the overall project would make a significant unique contribution to theoretical knowledge within the field of motor learning and experimental psychology. The outcomes are to provide the student an applied sport research experience that could have direct links to a career in sport science and publish in a peer reviewed journal.

**Aims/Hypothesis:**
The aim of the honours project is to examine the value of 2-dimensional video simulation training to the enhancement of anticipatory skill in intermediate level cricket batsmen and its transfer benefit to a natural setting of the skill.

**Background/Rationale:**
Little is known about the value of video-based simulation training to the enhancement of anticipatory skill in sport. Accordingly, this project attempts to further knowledge and understanding within the field of motor skill learning.

**Outcomes/Benefits:**
- The student will develop skills in applied sport science research which is an area currently funded by SMS and an area perceived as unique and innovative by RMIT SET Portfolio as well as external organisation such as the Australian Institute of Sport, Cricket Australia and Cricket Victoria.
- The skills developed as part of the honours year are directly linked to potential vocations such as sport science at Australian and state institutes of sports.
1. Project Title:
Adolescent girls and physical activity: What impacts their levels of participation

2. Supervisor/s: (include affiliations)
Dr. Bernie Holland, Senior Lecturer, Discipline of Exercise Sciences, School of Medical Sciences
Dr. Amanda Benson, Lecturer, Discipline of Exercise Sciences, School of Medical Sciences

3. Contact: (name, phone number and email address)
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Dr. Amanda Benson, 9925 7677, amanda.benson@rmit.edu.au

4. Project Description

Aims/Hypothesis:
The aim of this project is to examine variables that impact the participation of adolescent girls involvement in physical activity.

Background/Rationale:
Evidence suggests that during mid-adolescence girls are at an increased risk of developing an inactive lifestyle compared with other adolescence (Riddoch et al., 2004; Sallis, 2000). A number of studies have identified a range of variables and determinants that impact the physical activity participation among adolescents (Kohl & Hobbs, 1998; Sallis, Prochaska & Taylor, 2000). These determinants have typically been classified as physiological (e.g. growth, skill, fitness); environmental (e.g. facilities, seasonal); or, psychological and demographic (e.g. self-efficacy, parental influence, socioeconomic status).
The purpose of this study is to generate data on a range of these variables including:
- Questionnaire – demographic, attitudinal, participatory and self-perception of physical activity levels and motor skill ability
- Observational – involvement in school based educational and activity programs
- Performance levels – motor skill and Health Related Physical Activity levels
From these data relationships will be identified that influence the physical activity levels of adolescent girls to provide insight to enable location specific evidence based decisions for intervention design for the student to progress towards a Ph.D.

Outcomes/Benefits:
Research: Identification of key factors impacting the participation of adolescent girls in physical activity, including the student’s perception of their ability correlated with their actual performance level on a range of motor skill and physical activity variables.

Student: Understand the research and scientific writing process in preparation for progressing towards a Ph.D. and the ability to articulate the findings in both oral and written forms.

References: